integrated circuit package environment.

The Examiner is invited to contact the below-signed attorney with any questions regarding the present application.

Respectfully submitted,

STEVE VAN KIRK

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6913

Date 11/30/2001 By _____
Edward J. Brooks, III
Reg. No. 40,925

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 30 day of November, 2001.

Tina Pugh
Name

_____
Signature

CLEAN VERSION OF AMENDED SPECIFICATION PARAGRAPHS

SIGNAL MEASUREMENT APPARATUS AND METHOD
Applicant: Steve Van Kirk
Serial No.: 09/945,309

Paragraph beginning on page 13, line 16:

A1

After the voltage difference Vgnd is presented to the measurement circuit input 440, several possibilities exist with regard to measurement and further processing. For example, the measurement circuit 415 may include a comparison circuit 445, which provides a differential value to an analog-to-digital converter 450. The resulting digital signal value may then be sent directly to one or more output terminals 470 for access by the operator or designer of the integrated circuit 410. Alternatively, the measurement circuit may include an analog-to-digital converter 445 which feeds into a digital-to-analog converter 450. Then, the resulting analog signal can be sent directly to one or more output terminals 470 for access by the operator of the integrated circuit 410. In either case, several advantages are readily obtained by making use of the circuitry and methods of the present invention. First, accuracy is increased because measurements are made directly on-chip, without the added parasitic inductance and capacitance introduced by off-chip probing of a surrounding integrated circuit package. Second, measurement of the voltage Vgnd can be carried out without the need for special external equipment, since the analog parameters of the circuit 410 can be characterized during manufacture, and external measurement equipment probes can be further isolated from the measurement apparatus (e.g., using the analog-to-digital converter and digital-to-analog converter pair 445, 450). Third, attempts to measure the ground bounce voltage Vgnd should also be more accurate because the measurement is made by accessing test and reference domains selected and characterized during the manufacturing process, instead of whatever circuit domains happen to be connected to the circuit package leads.

Paragraph beginning on page 17, line 10:

A2

In accordance with the teachings of the present invention, at least one of the memory integrated circuit packages 710, in turn, may include a plurality of leads 715, wherein at least one of the leads 715 is connected to the conductive layer 705, using a through-hole via, or surface mounting pad 725, for example. The integrated circuit package includes a substrate 755 which has bonding pads 740 electrically connected to the leads 715 by wire bonds 750, as described above. The substrate 755, in turn, supports an integrated circuit 730 which includes a reference

A2 concluded

domain 760 and a test domain 770. The integrated circuit 730 may be fabricated apart from, or be fabricated to include the measurement circuit 785, also supported by the substrate 755. Again, the measurement circuit 785 is operatively connected to the reference domain 760 and the test domain 770 to measure the difference between the test and reference voltages developed therein.

Paragraph beginning on page 17, line 22:

A3

As described previously, an analog-to-digital converter 790, digital-to-analog converter 790, peak detector 790, comparison circuit 790, sample and hold circuit 790, and/or a complete data acquisition system 790, as are well known to those skilled in the art, can be used within the measurement circuit 785, formed as part of the integrated circuit 730, or apart from the integrated circuit 730, and supported by the substrate 755 to measure the magnitude and/or wave shape of the voltage Vgnd. Thus, there is no real limit to the number of devices, circuits, or methods which may be used within the measurement circuit 785 to measure the magnitude and/or wave shape of the voltage Vgnd within the memory circuit module 700.

Paragraph beginning on page 21, line 3:

A4

Alternatively, the measurement system 900 and measurement circuit 915 may include an analog-to-digital converter 945 which feeds into a digital-to-analog converter 950. Then, the resulting analog signal can be sent directly to one or more output terminals 970 for access by the operator of the oscilloscope 990, or the computer terminal 995. In either case, the user of the ground bounce measurement system 900 constructed and operated in accordance with the teachings of the present invention obtains the primary advantage noted previously, namely, the voltage Vgnd can be measured without the parasitic inductance and capacitance introduced by prior art methods involving integrated circuit packages and external probes. External measurement equipment can also be more completely isolated from the measurement apparatus (e.g., due to the isolation provided by the analog-to-digital converter and digital-to-analog converter pair 945, 950), if desired.

Paragraph beginning on page 21, line 15:

As noted above, a peak detector 955, whose output is sent to an analog-to-digital converter 945, directly to the outputs 970, and/or even to a data acquisition system 960, may also be included as part of measurement circuit 915. Thus, one or more values for Vgnd measured by the measurement circuit 915 may be presented continuously at the outputs 970, or acquired by the data acquisition system 960 for later readout by the attached devices 990 (e.g., oscilloscope) and/or a computer terminal 995.